



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

27 August 2009

CRUISE RESULTS

NOAA FRV *Gloria Michelle*
Gulf of Maine Northern Shrimp Survey
GM 09-02, Parts I-IV
12 July – 7 August 2009

INTRODUCTION

This report summarizes results of the 2009 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 26th survey conducted by the Northeast Fisheries Science Center (NEFSC) in cooperation with the Northern Shrimp Technical Committee of the Atlantic States Marine Fisheries Commission. The survey is designed to provide data required for annual stock assessments and related tasks.

METHODS

The survey cruise was conducted from 12 July – 7 August 2009 aboard FRV *Gloria Michelle*, a 72-foot, 96 gross registered ton (GRT) stern trawler powered by a 365 horsepower Caterpillar diesel engine. Fieldwork was overseen by NEFSC staff. Participants included two members of the Atlantic States Marine Fisheries Commission and other personnel from the NEFSC and state agencies of Maine and Massachusetts (see Appendix I).

A stratified random sampling design was used to select stations sampled during the survey (Figure 1). The number of stations allocated to each stratum was roughly proportional to the area of that stratum. Additional non-random stations were also occupied. Field work was conducted during daylight hours in recognition of diel changes in northern shrimp availability. The survey was conducted in four parts: Part I was during 12 – 16 July; Part II, 19 – 23 July; Part III, 26 – 31 July; Part IV, 3 – 7 August 2009. Locations of stations sampled during each part are given in Figure 2. The vessel departed Woods Hole, MA and made planned intermediate port calls in Portland, ME and Gloucester, MA before returning to Woods Hole, MA. Changes to the original cruise plan were: Part I returned one day early due to weather, and Part IV returned one day early due to the early completion of all stations.

At each station, a 15 minute tow was made at a vessel speed of two knots. Gear consisted of a four-seam modified commercial shrimp trawl fished at a scope of 3:1 in depths up to and including 85 fathoms; 250 fathoms of wire in depths between 86 and 100 fathoms; and a scope of 2.5:1 in depths greater than 100 fathoms. Reference/hull surface temperatures and meteorological observations were recorded at each station. A Vemco Minilogger was used to record the bottom temperatures during the survey. Northstar Technical Inc. Netmind Trawl Monitor System was used to monitor

trawl gear performance on most survey tows. Headrope height, wingspread and doorspread of the trawl were transmitted and logged electronically.

A 2 kilogram (kg) sample of Pandalid shrimp was collected at most stations to determine species composition. Length frequency measurements were collected for northern shrimp (mid- dorsal carapace length, rounded down to the nearest tenth of a millimeter) in addition to sex and female spawning condition (Rasmussen 1953; McCrary 1971). When less than 2 kg of shrimp was caught at a station, the entire catch was processed as described above.

For other species of invertebrates and finfish, standard NEFSC bottom trawl survey techniques (Azarovitz 1981, Grosslein 1969) were used to process the catch. Bony fish were measured to the nearest centimeter (cm) to the end of the central caudal ray; American lobsters were measured in millimeters (mm) from eye socket to end of carapace; and carapace width (cm) was recorded for crabs. Bivalves were measured by shell height (cm) and cephalopods were measured by mantle length (cm). All species weights were recorded to the nearest 0.001 kg. The remainder of the catch (miscellaneous invertebrates, trash, etc.) was recorded by volume. Total and individual weights and lengths information for shrimp and all other measured species were recorded directly into the Fisheries Scientific Computer System (FSCS).

RESULTS

A total of 88 stations were occupied. Northern shrimp were collected at 73 stations (Table 1). There were 17 non-random fixed stations. Stratum 2, tow 4 had the highest total number of northern shrimp while the lowest number was taken in Stratum 4, tow 2.

All shrimp, finfish, and select invertebrate data have been audited and archived in computer data files (total weight, number, and length frequencies). Scientific sample collections are summarized in Table 2. This information is available on request (refer to NEFSC Survey Master Data files Cruise Code 200970).

REFERENCES

- Azarovitz, T. R. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. Can. Spec. Publ. Fish. Aquat. Sci., 58: 62-67.
- Grosslein, M. D. 1969. Groundfish survey methods. NMFS, Woods Hole, Lab. Ref. Doc. 69-2, 34p.
- McCrary, J. A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. J. Fish. Res. Board Can., 28: 98-100.
- Rasmussen, B. 1953. On the geographical variation in growth and sexual development of the deep-sea prawn (Pandalus borealis kr.). Norway Fish. Mar. Invest. Rep., 10 (3); 1-160.

Table 1. Summary of stations and northern shrimp collected on the 2009 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 12 July – 7 August 2009.

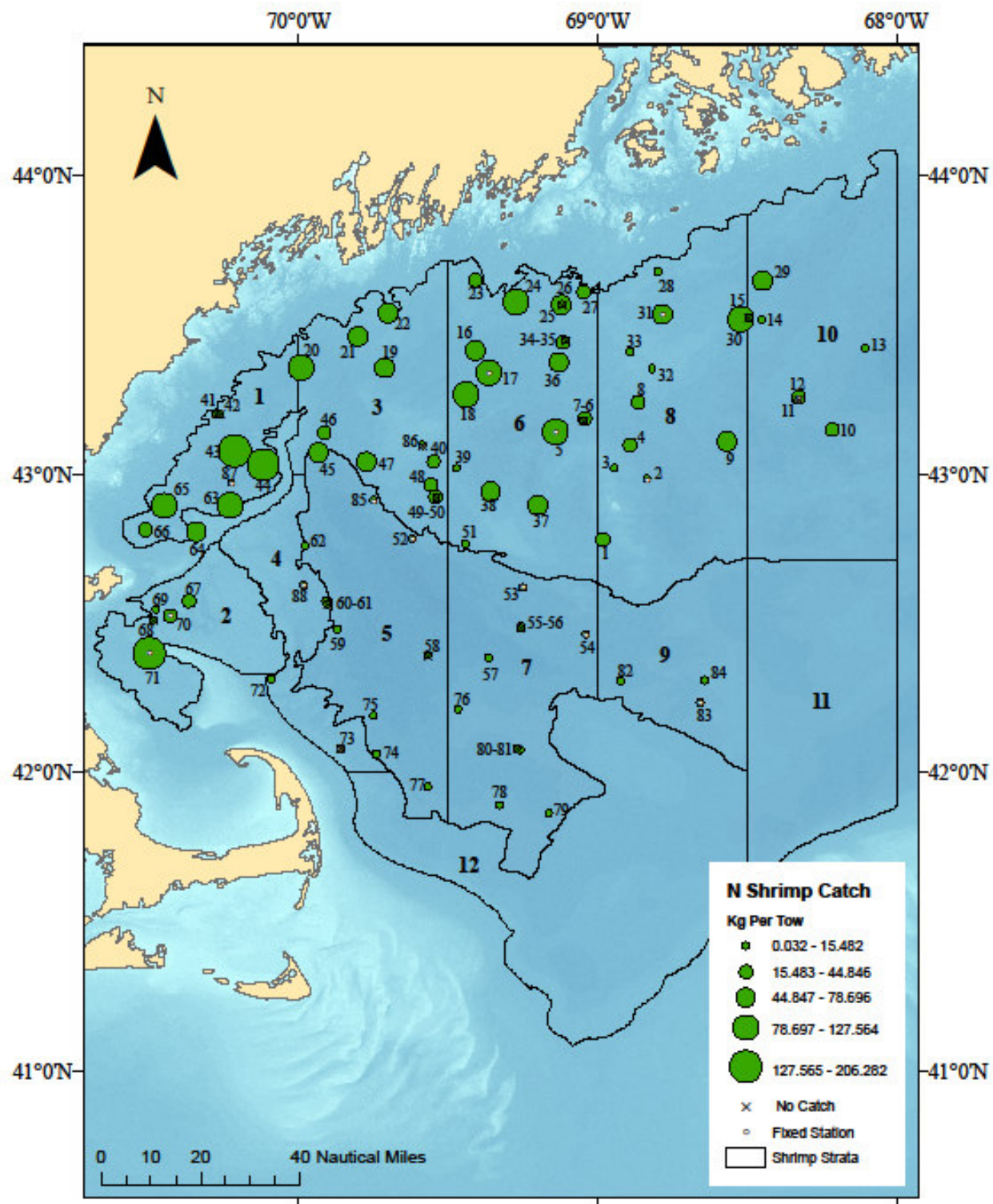
STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
8-12	1	42 46	68 58	165	4.9	831	1503	2334	24.48
8-9	2	42 58	68 49	175	6.4	294	1102	1396	13.85
8-7	3	43 01	68 56	139	5.2	221	516	737	6.00
8-4	4	43 05	68 53	180	5.2	285	3344	3629	35.17
6-15	5	43 08	69 08	182	5.3	3215	7211	10426	89.87
6-17	7	43 11	69 02	165	5.3	210	2100	2310	27.05
8-6	8	43 14	68 51	150	5.8	240	2709	2949	30.88
8-2	9	43 06	68 33	172	6.2	27	4624	4651	48.77
10-1	10	43 08	68 12	198	6.2	399	3040	3439	38.03
10-6	12	43 15	68 19	176	6.5	50	1429	1479	18.36
10-3	13	43 25	68 06	201	7.0	4	226	230	2.44
10-2	14	43 31	68 27	180	6.5	7	957	964	12.67
6-12	16	43 24	69 24	169	5.0	2526	4030	6556	59.23
6-16	17	43 20	69 21	175	5.0	9094	7815	16909	127.56
6-4	18	43 15	69 26	146	5.0	4564	6400	10964	88.07
3-3	19	43 21	69 42	167	5.3	3533	4455	7988	64.06
3-7	20	43 21	69 59	159	5.2	7980	9633	17613	109.02
3-8	21	43 27	69 48	136	5.2	8532	3779	12311	71.45
3-6	22	43 32	69 41	115	6.1	12402	3021	15423	78.70
6-7	23	43 38	69 24	129	5.8	8758	1537	10295	43.25
6-2	24	43 34	69 16	143	5.8	3555	5400	8955	83.37
6-18	26	43 33	69 07	137	6.1	10032	3572	13604	73.59
6-13	27	43 36	69 02	136	6.8	2559	896	3455	18.46
8-3	28	43 40	68 47	146	7.1	2484	506	2990	13.96
10-4	29	43 38	68 26	176	6.7	592	5106	5698	70.86
8-11	30	43 31	68 31	168	6.5	9462	5504	14966	104.61
8-10	31	43 32	68 46	140	6.8	3415	3226	6641	50.43
8-1	32	43 21	68 49	121	6.8	360	53	413	2.10
8-8	33	43 24	68 53	110	7.1	54	9	63	0.34
6-9	35	43 26	69 06	171	5.0	1653	1050	2703	21.30
6-11	36	43 22	69 07	153	5.0	2599	3952	6551	62.29
6-5	37	42 53	69 11	158	5.2	880	4972	5852	69.78
6-3	38	42 56	69 21	166	5.2	960	6120	7080	71.43
6-6	39	43 01	69 28	142	5.0	210	920	1130	13.07
3-5	40	43 02	69 32	156	5.5	2353	1381	3734	27.50
1-2	43	43 04	70 12	163	4.6	12084	14734	26818	206.28
1-5	44	43 01	70 07	159	4.4	22236	9996	32232	205.31
5-1	45	43 04	69 55	190	6.1	5245	2401	7646	48.87
3-10	46	43 08	69 54	173	5.8	2840	1376	4216	26.75
3-4	47	43 02	69 46	160	5.5	3577	3786	7363	67.03
3-1	48	42 57	69 33	159	5.3	2310	2012	4322	34.63
3-9	50	42 55	69 32	163	5.3	904	1729	2633	25.54

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
6-8	51	42 45	69 26	158	5.8	29	608	637	8.73
5-8	52	42 46	69 37	209	6.1	120	832	952	11.28
7-7	53	42 37	69 14	210	6.2	63	312	375	4.05
7-8	54	42 27	69 02	218	6.7	21	284	305	3.65
7-9	56	42 29	69 15	230	6.5	30	168	198	2.76
7-4	57	42 22	69 21	235	---	5	49	54	0.78
5-9	59	42 28	69 52	205	6.5	66	114	180	1.78
4-5	61	42 34	69 54	174	5.9	115	139	254	2.58
5-6	62	42 45	69 58	178	5.8	204	372	576	5.48
1-6	63	42 53	70 13	128	5.0	5716	6592	12308	91.93
1-4	64	42 48	70 20	109	5.2	14319	1803	16122	54.12
1-7	65	42 53	70 27	118	4.9	13680	3084	16764	88.02
1-1	66	42 48	70 30	114	4.6	12096	1421	13517	44.85
2-1	67	42 34	70 21	108	5.8	1959	1048	3007	18.01
2-5	69	42 32	70 28	86	6.1	1931	207	2138	10.11
2-3	70	42 31	70 25	96	---	7728	602	8330	22.72
2-4	71	42 23	70 29	85	5.2	34741	5490	40231	179.92
4-2	72	42 18	70 05	117	5.6	8	1	9	0.04
5-5	74	42 03	69 44	188	5.9	50	18	68	0.42
5-3	75	42 11	69 44	225	6.7	15	55	70	0.62
7-1	76	42 12	69 28	214	6.4	18	197	215	3.25
5-4	77	41 57	69 34	200	5.9	174	313	487	4.20
7-5	78	41 53	69 19	191	6.2	383	272	655	4.45
7-3	79	41 51	69 09	199	6.2	52	159	211	2.23
7-10	81	42 04	69 15	203	5.9	138	480	618	6.38
9-1	82	42 18	68 55	210	5.8	124	458	582	5.94
9-3	83	42 13	68 39	191	5.6	180	411	591	5.49
9-2	84	42 18	68 38	185	5.6	55	282	337	3.31
5-7	85	42 54	69 44	192	6.2	179	1249	1428	15.48
1-8	87	42 58	70 13	165	4.6	166	111	277	1.94
4-4	88	42 37	69 58	170	6.1	1265	640	1905	10.77

Table 2. Miscellaneous scientific collections made on the 2009 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 12 July – 7 August 2009.

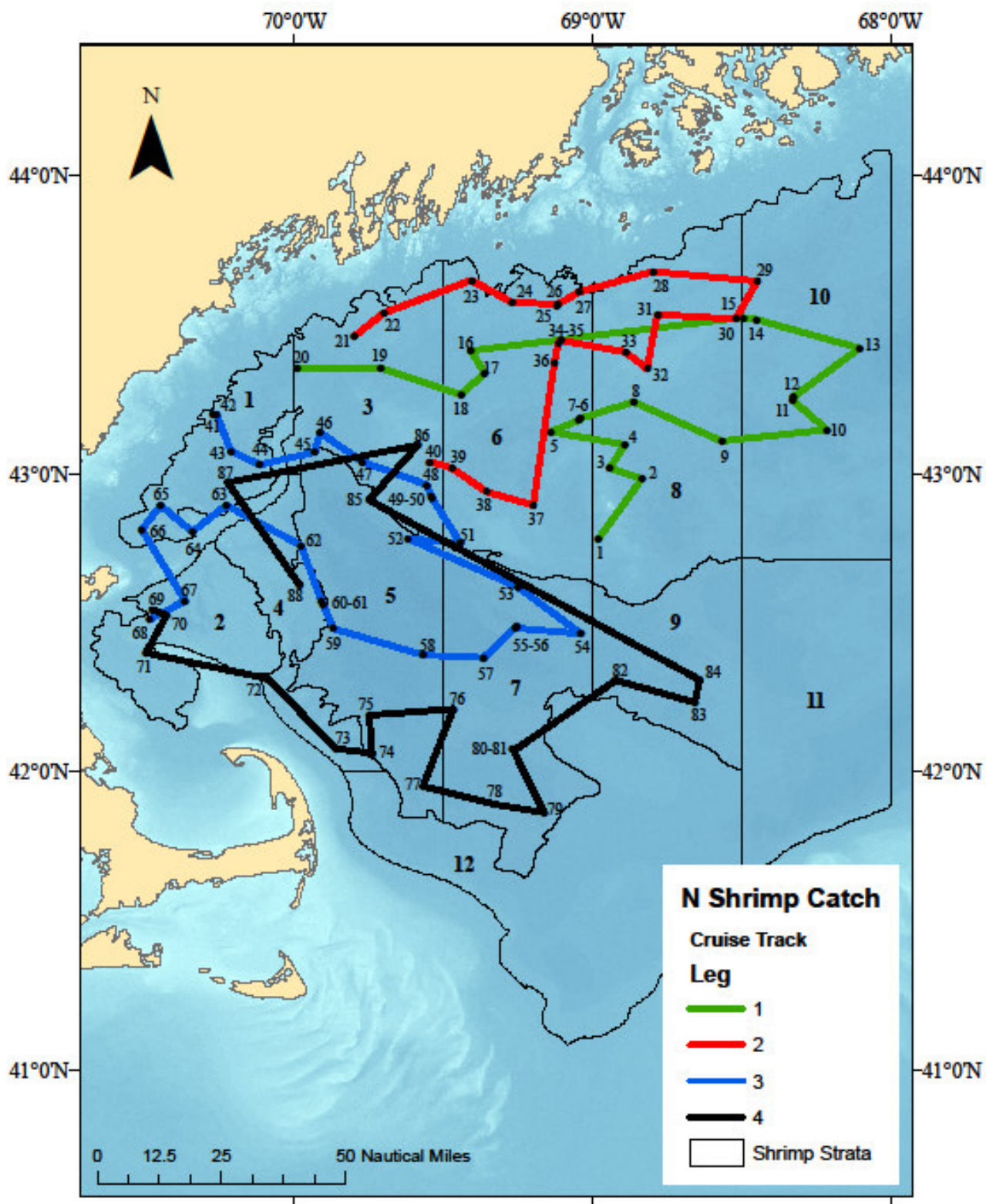
Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	Goosefish	14 vertebrae
	White Hake	259 otoliths
Aquarium, NMFS, NEFSC, Woods Hole, MA	Fourbeard Rockling	8 individuals
John Galbraith, NMFS, NEFSC, Woods Hole, MA	Various species	3 indiv.
Michelle Staudinger, U. of Massachusetts, Amherst, MA	Acadian Redfish	5 indiv.

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2009 Nation Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 12 July – 7 August 2009.



2009 Northern Shrimp Survey

Figure 2. Trawl hauls made during the 2009 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the Gulf of Maine aboard FRV *Gloria Michelle*, 12 July – 7 August 2009.



2009 Northern Shrimp Survey

Appendix I. Participants on the 2009 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey cruise in the western Gulf of Maine aboard FRV *Gloria Michelle*, 12 July to 7 August 2009.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist ^{1, 2}	Shad Mahlum ^{2, 3}
Rob Johnston, Chief Scientist ^{3, 4}	Nicole Perlot ⁴
TK Arbusto ¹	Sandy Sutherland ³
Kevin McIntosh ^{1, 4}	Grace Thorton ²

Atlantic States Marine Fisheries Commission, Washington, DC

Toni Kerns³
Brad Spear⁴

Gulf of Maine Research Institute, Portland, ME

Jacqueline Boudreau¹

Integrated Statistics, Woods Hole, MA

Heath Cook³
Melanie Underwood¹

MA Division of Marine Fisheries, Gloucester, MA

Brant McAfee²

MA Division of Marine Fisheries, New Bedford, MA

Beth Basinski²
Derek Perry²
Zach Boudreau³

ME Department of Environmental Protection, Augusta, ME

Doug Suitor¹

ME Department of Marine Resources, Boothbay, ME

Lessie White⁴

Deckhands

Michael Abbot³
Andrew Hall²
Richard Hester¹
Kurt Karpov⁴
Bill Sutter^{2, 3, 4}
William Wells¹

¹ 12 – 16 July

² 19 – 23 July

³ 26 – 31 July

⁴ 3 – 7 August